Appendix I: Selecting WTP Values for Benefits Transfer

Introduction

EPA identified eight surface water evaluation studies that quantified the effects of water quality improvements on various water-based recreational activities. As noted in Chapter 15 of this report, the Agency selected these studies based on the technical criteria for evaluating study transferability (Desvousges et al., 1987; and Boyle and Bergstrom, 1990):

- The environmental change valued at the study site must be the same as the environmental quality change caused by the rule (e.g., changes in toxic contamination vs changes in nutrient concentrations);

- The populations affected at the study site and at the policy site must be the same (e.g., recreational users vs nonusers);

- The assignment of property rights at both the study and policy sites must lead to the same theoretically appropriate welfare measure (e.g., willingness to pay (WTP) vs willingness to accept compensation); and

- The candidate studies should be based on defensible research methods. Six of the eight studies are published in peer reviewed journals. One study, Tudor et al. (2000), was presented at the annual American Agricultural Economic Association and the Northeastern Resource and Environmental Economic meetings. The eighth study, Lyke (1989), is an unpublished Ph.D. dissertation.

In addition to the above criteria, the Agency considered authors' recommendations regarding the robustness and theoretical soundness of various estimates in selecting point estimates for benefits transfer.

The rest of this appendix presents welfare estimates from seven studies used in estimating recreational benefits from the proposed regulation and provides EPA's reasons for selecting specific values from each study. The study by Tudor et al. (2000) is discussed in detail in Chapter 21. All welfare estimates from this study are eligible for use in benefits transfer, because the study is based on the policy scenarios specific to the MP&M regulation.

Appendix Contents:

I.1 Desvousges et al., 1987. Option Price Estimates for Water Quality Improvements: A Contingent Valuation Study for the Monongahela River

This study used findings from a ***contingent valuation (CV)*** survey to estimate WTP for improved recreational fishing from enhanced water quality in the Pennsylvania portion of the Monongahela River. In a hypothetical market, each survey respondent was asked to provide an option price for different water quality changes, such as "raising the water quality from suitable for boating (hereafter, 'boatable' water) to a level where gamefish would survive (hereafter, 'fishable' water)." Table I.1 lists water quality changes evaluated in the study and the corresponding WTP estimates. The following discussion provides justification for selecting the point estimates EPA used in the benefits transfer analysis in Chapter 15.

Table I.1: Changes in the Resource Value from a Specified Water Quality Improvement from Desvousges et al. (1987)

	Adjusted to 1999$			Original Estimates (1981$)		
Water Quality Change Valued	**User**	**Nonuser**	**Combined**	**User**	**Nonuser**	**Combined**
Iterative Bidding: $25 starting point						
Unsuitable to Boatable	$50.2	$54.4	$53.1	$27.4	$29.7	$29.0
Boatable to Fishable[a]	**$34.6**	$26.6	$29.1	**$18.9**	$14.5	$15.9
Fishable to Swimmable	$21.6	$13.2	$15.9	$11.8	$7.2	$8.7
Boatable to Swimmable	$58.8	$39.7	$46.0	$32.1	$21.7	$25.1
Unsuitable to Swimmable	$109.0	$94.1	$99.1	$59.5	$51.4	$54.1
Iterative Bidding: $125 starting point						
Unsuitable to Boatable	$173.5	$71.1	$105.1	$94.7	$38.8	$57.4
Boatable to Fishable	$106.4	$48.2	$67.6	$58.1	$26.3	$36.9
Fishable to Swimmable	$60.6	$21.2	$34.4	$33.1	$11.6	$18.8
Boatable to Swimmable	$182.6	$74.2	$110.3	$99.7	$40.5	$60.2
Unsuitable to Swimmable	$356.1	$145.1	$215.4	$194.4	$79.2	$117.6
Direct Question: no payment card						
Boatable to Unsuitable	$83.0	$26.0	$44.9	$45.3	$14.2	$24.5
Boatable to Fishable	$57.3	$19.8	$32.2	$31.3	$10.8	$17.6
Fishable to Swimmable	$37.0	$15.6	$22.7	$20.2	$8.5	$12.4
Boatable to Swimmable	$96.9	$37.2	$57.1	$52.9	$20.3	$31.2
Unsuitable to Swimmable	$179.9	$63.2	$102.0	$98.2	$34.5	$55.7
Direct Question: payment card						
Boatable to Unsuitable	$85.7	$97.1	$93.4	$46.8	$53.0	$51.0
Boatable to Fishable	$83.0	$40.1	$53.7	$45.3	$21.9	$29.3
Fishable to Swimmable	$41.9	$14.1	$22.9	$22.9	$7.7	$12.5
Boatable to Swimmable	$130.4	$54.8	$78.6	$71.2	$29.9	$42.9
Unsuitable to Swimmable	$216.0	$151.7	$172.0	$117.9	$82.8	$93.9

Location: Pennsylvania portion of the Monongahela River
Estimating Approach: CV
Survey Population : Recreational Users and Nonusers
a. The value selected for benefits transfer is given in bold.

EPA judged that only one value from this study met the requirements for the quality of research methods and was compatible with the environmental changes and population characteristics considered in the analysis of recreational benefits from the MP&M rule. EPA selected this value for the following reasons:

- **Environmental quality change**. The Desvousges et al. (1987) study derived WTP values for five different changes in water quality, as shown in Table I.1 above. EPA judged that only one of these improvements, from "boatable" to "fishable," is compatible with the changes in water quality expected under the MP&M rule. Streams unsuitable for recreational activities such as boating are likely to be affected by multiple environmental stressors from many sources including many that are not related to MP&M discharges (e.g., severe oxygen depletion.) In these cases it is reasonable to assume that changes in concentrations of MP&M pollutants would reduce or eliminate one of the stressors on the reach, but would be unlikely to change the designation of the reach.

The analysis in Chapter 15 assumes that reaches with ***ambient water quality criteria*** (AWQC) exceedances under the baseline conditions are boatable and likely to support rough fishing, but may not be clean enough to support game fishing. AWQC are set at a level below which pollutant concentrations are not expected to cause significant harm to human health or aquatic life. Exposure to pollutant concentrations above the AWQC levels are expected to have a harmful effect. Therefore, by definition, water with pollutant levels that exceed criteria set to protect human health or aquatic life are not suitable waters for sensitive aquatic species or ideal as a sources of fish for consumption.

Removing AWQC exceedances is therefore comparable to shifting water quality from "boatable"to "fishable." The Agency did not use the boatable to swimmable designation because a more limited number of reaches are suitable for swimming nationally due to reasons not related to MP&M discharges (e.g., amenities, pathogens). Determining national level locations affected by MP&M pollutants that are suitable for swimming required more resources than were available for the national analysis, but may be done in the future analyses.

- **Research methods**. The authors used four different payment vehicles in their CV study. For the recreational benefits analysis, EPA decided to use the WTP estimates derived from the "***iterative bidding***" **(IB)** payment vehicle, because it is universally preferred to the "***direct question/open-ended***" format for eliciting option price bids.

  Survey respondents in the direct question format are asked to state the most that they would be willing to pay for the program or policy. This format confronts respondents with an unfamiliar choice. Studies that use this approach usually have high non-response rates.

  Respondents in the IB format are asked whether they would be willing to pay a given amount. If the answer is yes, then this amount is raised in pre-set increments until the respondent says that he or she will not pay the last amount given. If the answer is no, then the amount is decreased until the respondent indicates WTP the stated amount. Some studies found that the respondent's final WTP amount depends on the initial amount offered (e.g., Boyle and Bishop, 1988). This problem is referred to in economic literature as starting point bias. The Agency selected the WTP estimates derived using the $25 starting point IB process to avoid upward starting point bias. Table I.1 shows that the selected estimates are the most conservative among all the payment vehicles used.

- **Population characteristics**. EPA selected WTP values for the user population to match population characteristics considered in our analysis (i.e., recreational anglers, boaters, and wildlife viewers).

I.2 Farber and Griner, 2000. Valuing Watershed Quality Improvements Using Conjoint Analysis

Farber and Griner (2000) used a CV study to estimate changes in water resource values to users from various improvements in Pennsylvania's water quality. The study defines water quality as "polluted," "moderately polluted," and "unpolluted" based on a water quality scale developed by EPA Region III. "Polluted" streams are unable to support aquatic life, "moderately polluted" streams are somewhat unable to support aquatic life, and "unpolluted" streams adequately support aquatic life. Farber and Griner developed WTP estimates for water quality improvements for the following three water quality changes:

- From "moderately polluted" to "unpolluted,"
- From "severely polluted" to "moderately polluted," and
- From "severely polluted" to "unpolluted."

The authors used six different model variations to estimate the WTP for the three improvements scenarios for various population groups (e.g., users, nonusers, and a mix of users and nonusers). Table I.2 presents the estimated WTP values. The following discussion provides EPA's reasons for selecting point estimates for the use in benefits transfer.

Table I.2: Estimate WTP for Specified Water Quality Improvements from Farber and Griner (1999$)

	Binary Choice Model			Intensity of Preference Model		
Water Quality Change Valued	**User**	**Nonuser**	**Combined**	**User**	**Nonuser**	**Combined**
Basic						
Moderately Polluted to Unpolluted	$46.77	$5.95	$38.04	$52.85	$13.13	$51.02
Severely Polluted to Moderately Polluted	$62.91	$5.50	$52.30	$69.42	$48.36	$66.70
Severely Polluted to Unpolluted	$110.35	$42.20	$90.01	$121.90	$54.26	$109.92
Interactive						
Moderately Polluted to Unpolluted	$45.36	$3.05	$35.76	$53.56	$12.55	$51.35
Severely Polluted to Moderately Polluted	$61.29	$1.39	$49.62	$70.63	$47.61	$67.64
Severely Polluted to Unpolluted	$108.68	$38.87	$87.43	$125.25	$54.22	$112.44
Fixed Effects						
Moderately Polluted to Unpolluted [a]	**$23.09**	$15.45	$26.63	**$39.34**	$5.17	$38.59
Severely Polluted to Moderately Polluted	$39.93	$10.01	$35.90	$59.67	$28.50	$55.46
Severely Polluted to Unpolluted	$81.42	$45.51	$75.63	$103.93	$29.15	$92.76

Location: Lower Allegheny Watershed in Western Pennsylvania
Estimating Approach: Conjoint Analysis
Survey Population: Recreational users and nonusers
a. Values selected for the use in benefits transfer are given in bold.

The Agency selected only two values from this study based on their compatibility with the environmental changes and population characteristics considered in both the original study and the analysis of recreational benefits from the MP&M rule. The following discussion summarizes EPA's reasons used in the selection process:

- **Environmental quality change**. EPA judged that only one water quality improvement scenario — change from "moderately polluted" to "unpolluted" — is compatible with the environmental quality change expected from the proposed regulation

  AWQC are set at a level below which pollutant concentrations have not been demonstrated to cause significant harm to human health or aquatic life. Exposure to pollutant concentrations above the AWQC levels are expected to have a harmful effect. Therefore, by definition, water with pollutant levels that exceed criteria set to protect human health or aquatic life are polluted waters.

  EPA chose the case where the policy variable changed from moderately polluted to unpolluted because this is likely to be the most frequently occurring scenario for reaches with MP&M discharges. Streams unable to support any aquatic life (i.e., "severely polluted") are likely to be affected by numerous environmental stressors, in addition to MP&M discharges. Eliminating MP&M related AWQC exceedences would eliminate or reduce one of the stressors, but is unlikely to change the quality of the water from severely polluted to unpolluted. It is more realistic to assume that most streams affected by MP&M facility discharges are moderately polluted, i.e., these streams support some aquatic life; but sensitive species are adversely affected by MP&M pollutants exceeding AWQC values protective of aquatic life. Removing all AWQC exceedances would make such streams unpolluted.

- **Research methods**. EPA considered only two of the six versions of the benefits transfer model based on the authors' recommendations. The authors appear to prefer the "fixed effects" versions of both the ***binary choice*** **(BC)** and ***intensity of preference*** **(IP)** models. Specifically, they note that, "A likelihood ratio test, with degrees of freedom being the number of individuals in the estimating sample, can be used to test the superiority of the fixed effects model. Such a test shows the fixed effects model to be a statistical improvement over either the basic or interactive models" (see Table I.2). In addition, they state that, "the purpose of estimating a fixed effects model was to account for the possibility that some respondents may approve of all changes, regardless of price and quality. If this behavior existed in the sample, not controlling for it would result in overestimates of marginal valuations for each type of quality change. This expectation is supported by the fact that the fixed effects valuation estimates are lower than the others."

- **Population characteristics**. EPA selected WTP values for the user population to match population characteristics considered in our national analysis (i.e., recreational anglers, boaters, and wildlife viewers).

I.3 JAKUS ET AL., 1997. DO SPORTFISH CONSUMPTION ADVISORIES AFFECT RESERVOIR ANGLERS SITE CHOICE?

Jakus et al. (1997) used a repeated discrete choice ***travel cost*** (TC) model to examine the impacts of ***fish consumption advisories*** (FCA) in eastern and middle Tennessee. The estimated consumer surplus from recreational fishing in middle and east Tennessee is $24.48 and $49.45 per angler per day, respectively, under the baseline water quality conditions. The estimated welfare gain from removing FCAs is $1.92 and $2.97 per angler per day , respectively. Table I.3 summarizes the study's estimates.

Table I.3:Consumer Surplus from Recreational Fishing from Jakus et al. (1997)[a]

Water Quality Change Valued	Consumer Surplus Adjusted to 1999$	Consumer Surplus ($1997)
Site Choice Model -- multinomial logit		
Average surplus per trip in middle TN (baseline water quality conditions)	**$24.48**	**$23.60**
Benefit per trip from removing all advisories in middle TN	**$1.92**	**$1.85**
Average surplus per trip in East TN (baseline water quality conditions)	**$49.45**	**$47.67**
Benefit per trip from removing all advisories in east TN	**$2.97**	**$2.86**
Benefit per trip from removing Watts Bar advisory	$1.65	$1.59
Repeated Discrete Choice Model -- repeated nested logit model		
Seasonal benefit from removing all advisories in middle TN	$22.78	$21.96
Seasonal benefit from removing all advisories in east TN	$49.17	$47.40
Seasonal benefit from removing Watts Bar advisory	$28.63	$27.60

Location: Tennessee
Estimating Approach: TC
Survey Population: Tennessee residents; anglers and non-anglers
a. Values selected for the use in benefits transfer are given in bold.

EPA selected two values from this study for use in benefits transfer, based on their compatibility with the environmental quality change and population characteristics at both the original study and policy sites, for the following reason:

- **Environmental quality change**. FCAs are usually triggered by the presence of toxic pollutants in fish tissue. EPA expects the proposed regulation to reduce discharges of toxic pollutants, including those linked to FCAs (e.g., mercury and lead). The Agency therefore assumed that the removal of FCAs is compatible with water quality improvement expected from the proposed regulation.

The recreational benefits analysis uses consumer surplus estimates for both regions studied by the authors, because MP&M facilities are located in these regions as well as throughout heavily populated regions of the U.S. EPA did not include the value corresponding to the Watts Bar lake in the benefit transfer analysis because this lake is included in the set of fishing areas for east Tennessee.

I.4 Lant and Roberts, 1990. Greenbelts in the Cornbelt: Riparian Wetlands, Intrinsic Values, and Market Failure

Lant and Roberts (1990) used a CV study to estimate the recreational and nonuse benefits of improved water quality in selected Iowa and Illinois river basins. River quality was defined by means of an interval scale of "poor," "fair," "good," and "excellent." The authors defined the four water quality intervals as follows:

- "poor" water quality is inadequate to support any recreation activity,
- "fair" water quality is adequate for boating and rough fishing,
- "good" water quality is adequate for gamefishing, and
- "excellent" is adequate to support swimming and exceptional fishing.

Table I.4 summarizes WTP values for specified water quality improvements from this study.

Table I.4: WTP Values for a Specified Water Quality Improvement from Lant and Roberts (1990)

	Adjusted to 1999$		Original Study Values $1987	
Water Quality Change Valued	**Use Value**	**Nonuse Value**	**Use Value**	**Nonuse Value**
Poor to Fair	$44.70	$55.12	$30.50	$37.61
Fair to Good [a]	**$54.38**	$69.12	**$37.10**	$47.16
Good to Excellent	$60.84	$63.35	$41.51	$43.22

Location: Selected Iowa and Illinois river basins
Estimating Approach: CV
Survey Population: Recreational users and nonusers
a. The values given in bold were selected for the use in benefits transfer.

The Agency judged that only one value from this study is compatible with the environmental changes and population characteristics considered in the analysis of recreational benefits from the MP&M rule, for the following reasons:

- **Environmental quality change**. The Agency judged that only one of the three possible water quality changes considered in this study — "fair" to "good" — was compatible with the water quality change expected under the MP&M rule. EPA assumed in its analysis of recreational benefits expected from the MP&M rule that reaches with AWQC exceedances under the baseline conditions are may support rough fishing, but may not be clean enough to support more sensitive species such as those desired for game fishing. Removing AWQC exceedances will shift water quality from "fair"to "good."
- **Population characteristics**. EPA selected WTP values for the user population only to match population characteristics considered in our analysis (i.e., recreational anglers, boaters, and wildlife viewers).

I.5 Audrey Lyke, 1993. Discrete Choice Models to Value Changes in Environmental Quality: A Great Lakes Case Study

Lyke's (1993) study of the Wisconsin Great Lakes open water sport fishery showed that anglers may place a significantly higher value on a contaminant-free fishery than on one with some level of contamination. Lyke estimated the value of the fishery to Great Lakes trout and salmon anglers if it was improved enough to be "completely free of contaminants that may threaten human health." The author also estimated various policy scenarios that affect the value of recreational fishing in the Wisconsin Great Lakes, including reducing the daily bag limit for lake trout and restoring naturally reproducing populations of lake trout.

Table I.5 presents welfare estimates from this study.

Table I.5: WTP Estimates for a Specified Water Quality Improvements from Lyke (1993)

Water Quality Change Valued	Adjusted to 1999$ Value of WI Fishing	Adjusted to 1999$ Change in Value	Original Study Value (1989$) Value of WI Fishing	Original Study Value (1989$) Change in Value
CV -- linear logit model				
1990 fishing conditions remain the same as 1989	**$89,426,613**		**$66,600,000**	
WI daily bag limit for lake trout reduced to one a day	$41,356,452	-$48,070,161	$30,800,000	-$35,800,000
Great Lakes fish are free of pollutants affecting human health	$99,362,903	**$9,936,290**	$74,000,000	**$7,400,000**
Restoring naturally reproducing populations of lake trout	$16,247,177	$16,247,177	$12,100,000	$12,100,000
WI inland fishing conditions remain the same as 1989	$907,156,452		$675,600,000	
Restoring naturally reproducing populations of lake trout in WI waters of Great Lakes (inland anglers only)	$0	$0	$0	$0
CV -- constant elasticity of substitution model (mean)				
1990 fishing conditions remain the same as 1989	**$111,850,403**		**$83,300,000**	
Great Lakes fish are free of pollutants affecting human health	$146,761,694	**$34,911,290**	$109,300,000	**$26,000,000**
CV -- constant elasticity of substitution model (median)				
1990 fishing conditions remain the same as 1989	$25,243,548		$18,800,000	
Great Lakes fish free of pollutants that affect human health	$38,133,871	$12,890,323	$28,400,000	$9,600,000

Location: Wisconsin
Estimating Approach: TC and CV
Survey Population: Wisconsin Great Lakes and inland anglers
a. The values selected for the use in benefits transfer are given in bold.

EPA selected two WTP values from this study for use in benefits transfer for the following reasons:

- **Environmental quality change**. EPA judged that only one policy scenario — Great Lakes fish that are free from contaminants harmful to human health — is compatible with water quality improvements expected under the proposed regulation (i.e., removal of AWQC exceedances). Other scenarios, such as reducing daily bag limit for lake trout to one per day and restoring naturally reproducing populations of lake trout, are irrelevant to the MP&M regulation. The Agency used estimates from the "no change in 1990 fishing conditions compared to 1989" scenario as an estimate of the baseline value of recreational fishing in Wisconsin.

- **Research methods**. The Agency did not consider estimates from the TC model because the author noted that "the nested logit travel cost model results seem too high."

I.6 Montgomery and Needelman, 1997. The Welfare Effects of Toxic Contamination in Freshwater Fish

Montgomery and Needelman (1997) estimated benefits from removing "toxic" contamination from lakes and ponds in New York State. They used a binary variable as their primary water quality measure, which indicates whether the New York Department of Environmental Conservation considers water quality in a given lake to be impaired by toxic pollutants. Their model controls for major causes of impairments other than "toxic" pollutants, to separate the effects of various pollution problems that affect the fishing experience. Table I.6 lists environmental quality changes considered in the study and the WTP values corresponding to a specified water quality change.

Table I.6: Welfare Estimates from Montgomery and Needelman (1997)

Water Quality Change Valued	Compensating Variation per Capita per Season (1999$)	Compensating Variation per Capita per Season (1989$)
Eliminate toxic contamination in all lakes [a]	**$84.93**	**$63.25**
All toxic lakes are closed to fishing	$116.94	$87.09
Raise pH in acidic lakes (none are threatened or impaired)	$18.56	$13.82
Close all acidic lakes to fishing	$19.94	$14.85
Eliminate toxic contamination and raise pH in acidic lakes	$106.67	$79.44

Location: New York State
Estimating Approach: TC -- Repeated discrete choice model
Survey Population: New York State residents; anglers and non-anglers
a. The values selected for the use in benefits transfer are given in bold.

The Agency selected only one value from this study for use in the benefits transfer based on its compatibility with environmental quality changes at both the original study and the MP&M sites, for the following reason:

- **Environmental quality change**. Only one of the five policy scenarios considered — removing toxic contamination in all lakes — is directly compatible with the potential changes brought about by the MP&M rule. The MP&M rule is unlikely to significantly affect the acidity in lakes and streams affected by MP&M discharges. The last three policy scenarios in Table I.6 involve changes in pH levels, and are therefore not included in the benefits transfer. The Agency also did not consider the estimate from the second scenario in table I,6 — closing all toxic lakes to fishing — in benefits transfer, because it does not consider water quality improvement per se.

I.7 Phaneuf et al., 1998. Valuing Water Quality Improvements Using Revealed Preference Methods When Corner Solutions are Present

Phaneuf et al. (1998) studied angling in Wisconsin Great Lakes. They estimated changes in recreational fishing values resulting from a 20 percent reduction of toxin levels in lake trout flesh. The study uses a TC model to value water quality improvements when ***corner solutions*** are present in the data. Corner solutions arise when consumers visit only a subset of the available recreation sites, setting their demand to zero for the remaining sites. Phaneuf et al. found that improved industrial and municipal waste management results in general water quality improvement. Table I.7 presents findings from this study based on two policy scenarios and four different model specifications.

Table I.7: Welfare Estimates from Phaneuf et al. (1998)

	Adjusted to 1999$				Study Values (1989$)			
Water Quality Change Valued	RNL	RPRNL	KT	System	RNL	RPRNL	KT	System
20% reduction in toxins	$39.15	$11.79	**$156.36**	$14.76	$29.16	$8.78	**$116.45**	$10.99
Loss of South Lake Michigan	$218.42	$132.05	$1,140.11	$415.19	$162.67	$98.34	$849.09	$309.21

Location: Wisconsin Great Lakes
Estimating Approach: TC models, including:
RNL: Repeated Nested Logit Model;
RPRNL: Random Parameters Repeated Nested Logit Model;
KT: Kuhn-Tucker Model; and
System: Systems of Demands Model
Survey Population: Wisconsin anglers; Great Lakes and inland anglers

The Agency selected only one value for use in benefits transfer for the following reasons:

- **Environmental quality change**. Only one policy scenario evaluated in this study — a 20 percent reduction in the toxin levels in fish tissue — is compatible with the water quality changes expected from the MP&M regulation (i.e., removal of aquatic life-based AWQC exceedances. The second scenario — loss of South Lake Michigan — is irrelevant to the proposed regulation.

- **Research methods**. Phaneuf et al. estimated four different models and provided WTP estimates based on each of them. The authors indicated, however, that " the KT model comes closest to matching the ideal theoretical model" (see authors conclusions, page 1030). Other models either rely on more restrictive assumptions or require additional research. The Agency chose the value from the KT model based on the authors' recommendation, which is one of the selection criteria for values used in the benefits transfer.

GLOSSARY

ambient water quality criteria (AWQC): Levels of water quality expected to render a body of water suitable for its designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes. (http://www.epa.gov/OCEPAterms/aterms.html)

binary choice (BC): offers respondents to a contingent valuation survey specific dollars and cents choices, for example, would you be willing to pay between $10 and $20 per year to improve visibility at the Grand Canyon.

conjoint analysis: CJ is defined as "any decompositional method that estimates the structure of consumer's preferences…given his or her overall evaluations of a set of alternatives that are prespecified in terms of levels of different attributes. Price typically is included as an attribute." (Green and Srinivasan, 1990).

contingent valuation (CV): a method used to determine a value for a particular event, where people are asked what they are willing to pay for a benefit and/or are willing to receive in compensation for tolerating a cost. Personal valuations for increases or decreases in the quantity of some good are obtained contingent upon a hypothetical market. The aim is to elicit valuations or bids that are close to what would be revealed if an actual market existed. (http://www.damagevaluation.com/glossary.htm)

corner solutions: a corner solution arise when a consumer who has a choice of two goods, x_1 and x_2, chooses to consume no x_1 at the utility maximum.

direct question/open-ended (OE): in the OE approach, respondents are asked the most they would be willing to pay for the program or policy. This approach has a virtue of not providing any hints about what might be a reasonable value. This approach, however, confronts respondents with an unfamiliar choice (i.e., placing a price on environmental commodities). Studies that use the OE approach have high item non-response rates.

fish consumption advisory (FCA): an official notification of the public about specific areas where fish tissue samples have been found to be contaminated by toxic chemicals which exceed FDA action limits or other accepted guidelines. Advisories may be species specific or community wide.

intensity of preference (IP): the experimental design allows individuals to state an intensity of preferences for or against the alternative to the status quo. For example, the individual designates they would "probably yes" or "definitely yes" prefer the alternative to the status quo.

iterative bidding (IB): with IB, respondents are asked whether they would be WTP a given amount. If the answer is yes, this amount is raised in pre-set increments until the respondent says that he will not pay the last amount given. If the answer is no, then the amount is decreased until the respondent indicates a willingness to pay the stated amount.

starting point bias: because survey interviewers suggest the first bid this can influence the respondents answer and cause the respondent to agree too readily with bids in the vicinity of the initial bid. (http://www.damagevaluation.com/glossary.htm)

travel cost (TC): method to determine the value of an event by evaluating expenditures of recreators. Travel costs are used as a proxy for price in deriving demand curves for the recreation site. (http://www.damagevaluation.com/glossary.htm)

willingness to pay (WTP): maximum amount of money one would be willing to pay or give up to buy some good. (http://www.damagevaluation.com/glossary.htm)

ACRONYMS

AWQC: ambient water quality criteria
BC: binary choice
CV: contingent valuation
FCA: fish consumption advisory
IB: iterative bidding"
IP: intensity of preference
TC: travel cost
WTP: willingness to pay

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